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(54) Title of the Invention Touch Operation Type Computer

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(54) [Title of the Invention] Touch operation type computer

(57) [Abstract]
[Problem to be Solved] This computer makes the input means diverse and multifunctional to improve the operability.
[Solution] An information terminal equipped with a keyboard that has multiple keys equipped with touch detection sensors on the tops of the keys enabling keyboard input to be conducted via pointing without moving the hand. Also, for portable information terminals such as PDA (Personal Digital Assistant), PC card type information terminals, IC card type information terminals and credit card sized IC cards, it is possible to perform capacitive input and contact event input using the touch of a finger via a touch detection means and a click switch with either uniform or non-uniform arrangement of touch detection sensors continuously in a straight line, plane curve or arc.

[Claims]

[Claim 1] An information terminal equipped with an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; and a means to detect the finger or hand movement when the keyboard is touched on the group of contact detection sensors on the tops of keys.

[Claim 2] A portable information terminal equipped with an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; and a means to detect the finger or hand movement when the keyboard is touched on the group of contact detection sensors on the tops of keys.

[Claim 3] An information terminal equipped with an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; a touch pad; and a means to detect the finger or hand movement when there is contact with the keyboard on the group of contact detection sensors on the tops of keys and with the touch pad.

[Claim 4] An information terminal equipped with a character and graphic display means, an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; and a means to detect the finger or hand movement when the keyboard is touched on the group of contact detection sensors on the tops of keys.

[Claim 5] A portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching

means; and a means to detect the finger or hand movement when the keyboard is touched on the group of contact detection sensors on the tops of keys.

[Claim 6] An information terminal equipped with a character and graphic display means, an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; a touch pad; and a means to detect the finger or hand movement when there is contact with the keyboard on the group of contact detection sensors on the tops of keys and with the touch pad.

[Claim 7] A portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; a touch pad; and a means to detect the finger or hand movement when there is contact with the keyboard on the group of contact detection sensors on the tops of keys and with the touch pad.

[Claim 8] A personal computer equipped with a character and graphic display means, an arithmetic device and a memory that has a keyboard as indicated above.

[Claim 9] A portable personal computer equipped with a character and graphic display means, an arithmetic device and a memory that has a keyboard as indicated above.

[Claim 10] A workstation equipped with a character and graphic display means, an arithmetic device and a memory that has a keyboard as indicated above.

[Claim 11] A word processor equipped with a character and graphic display means, an arithmetic device and a memory that has a keyboard as indicated above.

[Claim 12] An information processing device as claimed in Claims 1-11 that is equipped with a keyboard substrate and a non-contact detection sensor between the top of the keys and the keyboard substrate instead of the aforementioned touch operation keyboard, and a means to detection the position of the finger or hand on the keyboard.

[Claim 13] A portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an input device containing a touch detection means with touch detection sensors arranged continuously in a straight line, plane curve or arc; a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.

[Claim 14] A portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an integrated input device that is comprised of a switching means to turn the contact points on and off by movement or pressure; and an input device containing a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.

[Claim 15] A PDA (Personal Digital Assistant) equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.

[Claim 16] A PDA (Personal Digital Assistant) equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an integrated input device that is comprised of a switching means to turn the contact point on and off by movement or pressure; and an input device containing a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.

[Claim 17] An IC card type information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.

[Claim 18] A PDA (Personal Digital Assistant) equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an integrated input device that is comprised of a switching means to turn the contact point on and off by movement or pressure; and an input device containing a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.
[Claim 19] A PC card type information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.
[Claim 20] An information processing device as claimed in Claims 1-19 that contains the aforementioned keyboard and the aforementioned input device as well as a detection calculation means and a transmission means.
[Claim 21] A card type information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a solar battery that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory as detection information.
[Claim 22] An IC card equipped with an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration for the signal or voltage corresponding to that touch according to the contact or pressure from the point of contact input repeatedly along a trajectory.
[Claim 23] An IC card equipped with a character display means or a luminous means with a luminous element, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc;

and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration for the signal or voltage corresponding to that touch according to the contact or pressure from the point of contact input repeatedly along a trajectory.

[Claim 24] An IC card equipped with a character display means or a luminous means with a luminous element, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with varying densities of touch detection sensors arranged along a specific line or plane curve; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration for the signal or voltage corresponding to that touch according to the contact or pressure from the point of contact input repeatedly along a trajectory.

[Claim 25] An IC card as claimed in Claims 22-24 where there are multiple items and a cursor to display which items are currently selected on the aforementioned display means; and a means to synchronize the movement of the event information calculation with the cursor by repeated contact detection using the aforementioned input device.

[Claim 26] A portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory, a keyboard and a touch pad containing a palm rest that is equipped with an input device that is comprised of an input device containing touch detection sensors arranged along a specific line or plane curve around the touch pad; and a detection means to detect the position on the input device touched by a finger.

[Claim 27] A portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a keyboard that is comprised of an input device containing touch detection sensors arranged along a specific line or plane curve and a touch pad integrated with a palm rest; and a detection means to detect the position on the input device touched by a finger.

[Claim 28] A portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a keyboard that is comprised of an input device containing touch detection sensors around a touch pad arranged along a specific line or plane curve and a touch pad integrated with a palm rest; and a detection means to detect the position on the input device touched by a finger.

[Claim 29] A portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a keyboard that is comprised of a touch pad with a palm rest; a means for pointing on a two-dimensional plane on part of the touch pad

where contact is not possible; and an input device containing touch detection sensors arranged along a specific line or plane curve.
[Claim 30] A portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a keyboard that is comprised of a touch pad with a palm rest; and an input device containing touch detection sensors arranged along a specific line or plane curve used as a touch position detection means along a specific line to identify sections visually from the touch pad surface contacted.
[Claim 31] A portable information terminal as claimed in Claims 26-30 with a click switch on the input device or on the input device around the touch pad.
[Detailed Explanation of the Invention]
[0001]
[Industrial Field of Application] This invention relates to an information processing device that has arithmetic processing functions, in particular, a computer that can conduct operations via human touch. Specifically, it is a product that is an information terminal combined with a keyboard such as a personal computer or a word processor, a portable information terminal or a compact electronic device with multiple input items and multiple input data that can detect contact of input operations. It is designed to improve the operability of portable personal computers, PDA and IC card type information devices.
[0002]
[Existing Technology] In the existing field of information processing, information processing devices generally use a mouse as the pointing device. This hand held device moves around on a desktop to input changes into the computer. Since it is a common device, the description has been abbreviated. Additionally, tracking balls and joy sticks are used as pointing devices. Touch pads are generally used for fingertip touch input on portable personal computers. There are many problems with these pointing devices. The mouse has good operability but can only be used on top of flat desktops. Also, it is necessary to remove ones hand from typing on the keyboard to use the pointing device. Touch pad input requires extremely delicate finger control, but this also requires removing ones hand from the keyboard and exercising care for input. Other pointing devices also require removing ones hand from the keyboard. These pointing devices are generally used to move a cursor around a monitor. When considering the two pointing devices mentioned above, it is difficult to control a cursor on a screen using a fingertip on a touch pad

but it is easy to control a mouse using a palm, wrist and arm.
[0003] An example of an information terminal containing a microprocessor arithmetic device and a memory is the PDA (Personal Digital Assistant). Examples of compact computer such as portable information terminals containing the operating system WindowsCE from Microsoft include the brand name Zaurus from Sharp Corporation, the brand name Newton from Apple Computer and the brand name Palm Pilot from Robotics. In general, PDAs can be called electronic notebooks. With existing compact electronic devices, IC cards or PDAs, there are serious user interface problems with high functionality, multi-functionality and large information capacity relative to the lightweight compact size. In spite of the smaller, lighter size, there are more functions. The device itself requires a push switch for these functions. These devices with high functionality, multi-functionality and large information capacity can be equipped with multiple push switches that perform the commands using a pen or a fingertip on a touch pad on the liquid crystal display. Currently, key input on card type calculators includes a matrix of pairs of contact points with moveable contacts on a substrate that are pressed down from the top to turn the contact point on. This is an input device where the keys are separately pressed but does not include an algorithm or processing means that can select multiple items via finger input. Smooth finger motion on the data pointer or cursor control for data selection does not meet the objectives. Existing portable personal computers come equipped with a touch pad. Recently, in addition to the pointing devices for displacement values on a two-dimensional plane, mouse pointing devices that input one-dimensional displacement values have been found in the marketplace. It is hoped that portable personal computers will contain these one-dimensional input devices.
[0004] This includes a touch panel with this contact detection structure that contains the contact detection functions from keyboards. This is an invention of a combination touch panel and keyboard, so the following items are provided as representations of touch panel structure and methods.
1) Electrostatic induction: This is a 2-dimensional touch position detection method that detects electrostatic capacity conversions as signal conversions such as frequency and phase conversions when the panel surface is touched and not touched. Examples include "PCT International Kokai W092/08947 Report", "PCT International Kokai W092/14604 Report", "IEEE Computer Society Press Report 'A Capacitance-based Proximity Sensor for Wholearm Obstacle Avoidance', J.L.Noval, J.T.Feddema, Reprinted form Proceedings of the 1992 IEEE International Conference on Robotics and Automation, Nice, France, May 12-14, 1994", and "Kokai H8-77894 Report".

2) Resistant Film: An electrical potential distribution was generated on two conductive sheets using an X-axis and Y-axis. The change in voltage when the panel surface on the conductive sheet is touch is detected by the touch position detection method on a 2-dimensional surface. This can also be an analog or digital method. Examples include those in "Kokai S47-36923 Report", "Kokai S61-208533 Report", "Kokai H8-54976 Report", "Kokai H4-4420 Report", "Kokai H4-15813 Report".
3) Moveable Electrode: Multiple electrodes were arranged on one side of a gap such as one parallel to the Y-axis using position detection on the X-axis of a 2-dimensional surface. Multiple electrodes were arranged perpendicular on the Y-axis. These were designated moveable electrodes so there was a touch position detection method on a 2-dimensional surface by detecting contact with several electrodes from pressure along the Z-axis. An example is in the "Kokai H4-15723 Report".
4) Optical Detection: Infrared LED or phototransistors were arranged on both sides of a gap parallel to the Y-axis using touch detection on the X-axis of a 2-dimensonal surface. Infrared LED or phototransistors were arranged on both sides of a gap perpendicular to this using touch detection on the Y-axis. By pressing from the Z-axis direction, the touch position detection method on a 2-dimensional surface detects the position and the range where the optical beam was interrupted. Examples are in the "Kokai H2-53129 Report" and the "Kokai H5-35403 Report".
[0005]
[Problems this Invention is to Solve] First, information is input using a standard keyboard on information processing terminals, portable information processing terminals and compact information processing terminals. On these keyboards, typically the cursor is moved using the up/down/left/right arrow keys. However, when the cursor is a pointing device, it is not controlled by arrow keys. It is standard that the keyboard does not have the function to control the arrow cursor movement. A keyboard differs from a touch pad in that there is sufficient space for movement using the palm of a hand,

the wrist and the arm. There should be a pointing device that efficiently utilizes this space. In particular, portable personal computers and portable work stations come integrated with a keyboard, pointing device, monitor and CPU so the keyboard is an essential component of the entire unit. If the keyboard can function as a pointing device, it will be possible to provide a portable computer with excellent operability.

[0006] Existing information terminals equipped with an arithmetic device such as a microprocessor and a memory such as compact electronic devices, IC cards or PDAs are very technologically advanced with highly integrated microprocessors and memory in the device that also has large information storage capacity. It is also necessary to make progress towards efficiently reducing the number of hardware parts for user interface and input. At the present time, if the touch panel with these parts is directly touched with a fingertip, the monitor gets dirty, which interferes with its use. When a pen is used, it cannot be operated with one hand. With a jog dial, the convenience relative to a PDA or compact electronic device is improved to a certain degree but not for thin IC cards or credit card types, so it is not applicable. For this type of device, when inputting without a touch panel or jog dial, single event input is conducted by pressing down a push key but there are never enough keys. The number of keys required to perform input of many events by pressing down is excessive. To avoid this, an input device that can continuously conduct event input with delicate fingertip operation is needed. To rapidly input many events, there are push keys that transmit items as long as the key is pressed but it is easier for humans to recognize fingertip movement instead of time. For this structure, there are multiple touch event detection mechanisms arranged along a trajectory. It is possible to effectively use these for touch events on an electronic device. For smooth selection of multiple functions and large amounts of information, the software program data pointer movement for the selected function as well as the touch event detection hardware can control the continuous data input using a touch detection mechanism as well as movement of the data pointer or cursor. In general, an information processing terminal that processes data and conducts data control is called a computer. This invention is equipped with an arithmetic device and a memory so can solve the problems found on information terminals, portable information terminals, personal computers, portable personal computers, work stations, word processors, information processing devices, PDAs (Personal Digital Assistants), IC card type information terminals, card type information terminals and IC cards.

[0007]

[Means of Solving These Problems] This computer invention solves the problems listed above by combining two input mechanisms. First, the primary input mechanism is a keyboard with touch detection sensors on the top of the keys that detects movement of a hand contacting the keyboard, and so functions as a pointer device. This invention combines this keyboard and touch pad. Next, the secondary input mechanism detects touch by fingertips along a specific trajectory with touch detection sensors continuously arranged along the specific trajectory and is a means to input multiple events. Using the primary input mechanism, keys equipped with touch detection sensors on the tops act as a secondary input mechanism when arranged along a specific trajectory.

[0008] This invention combines these two input mechanisms as follows. The first invention solves the aforementioned problems with an information terminal equipped with an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; and a means to detect the finger or hand movement when the keyboard is touched on the group of contact detection sensors on the tops of keys. The second invention solves the aforementioned problems with a portable information terminal equipped with an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; and a means to detect the finger or hand movement when the keyboard is touched on the group of contact detection sensors on the tops of keys. The third invention solves the aforementioned problems with an information terminal equipped with an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; a touch pad; and a means to detect the finger or hand movement when there is contact with the keyboard on the group of contact detection sensors on the tops of keys and with the touch pad. The fourth invention solves the aforementioned problems with

an information terminal equipped with a character and graphic display means, an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; and a means to detect the finger or hand movement when the keyboard is touched on the group of contact detection sensors on the tops of keys.
[0009] The fifth invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; and a means to detect the finger or hand movement when the keyboard is touched on the group of contact detection sensors on the tops of keys. The sixth invention solves the aforementioned problems with an information terminal equipped with a character and graphic display means, an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; a touch pad; and a means to detect the finger or hand movement when there is contact with the keyboard on the group of contact detection sensors on the tops of keys and with the touch pad. The seventh invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that contains contact detection sensors on the tops of keys; a keyboard constructed of multiple keys that have a switching means to turn contact points on and off with physical movement or pressure that performs contact event detection generated by each key touch and performs detection of the contact point state with the switching means; a touch pad; and a means to detect the finger or hand movement when there is contact with the keyboard on the group of contact detection sensors on the tops of keys and with the touch pad.
[0010] The eighth invention solves the aforementioned problems with a personal computer equipped with a character and graphic display means, an arithmetic device and a memory that has a keyboard as indicated above. The ninth invention solves the aforementioned problems with a portable personal computer equipped with a character

and graphic display means, an arithmetic device and a memory that has a keyboard as indicated above. The tenth invention solves the aforementioned problems with a workstation equipped with a character and graphic display means, an arithmetic device and a memory that has a keyboard as indicated above. The eleventh invention solves the aforementioned problems with a word processor equipped with a character and graphic display means, an arithmetic device and a memory that has a keyboard as indicated above. The twelfth invention solves the aforementioned problems with an information processing device that is equipped with a keyboard substrate or a non-contact detection sensor between the top of the keys and the keyboard substrate instead of the aforementioned touch operation keyboard, and a means to detection the position of the finger or hand on the keyboard.

[0011] The thirteenth invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an input device containing a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory. The fourteenth invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an integrated input device that is comprised of a switching means to turn the contact point on and off by movement or pressure; and an input device containing a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.

[0012] The fifteenth invention solves the aforementioned problems with a PDA (Personal Digital Assistant) equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory. The sixteenth invention solves the aforementioned problems with a PDA (Personal Digital Assistant) equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an integrated input device that is comprised of a switching means to turn the contact point on and off by movement or pressure; and an input device containing a

touch detection means with touch detection sensors continuously arranged along a

specific line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory.

[0013] The seventeenth invention solves the aforementioned problems with an IC card type information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory. The eighteenth invention solves the aforementioned problems with a PDA (Personal Digital Assistant) equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an integrated input device that is comprised of a switching means to turn the contact point on and off by movement or pressure; and an input device containing a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory. The nineteenth invention solves the aforementioned problems with a PC card type information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory. The twentieth invention solves the aforementioned problems with information processing device as claimed in Claims 1-19 that contains the aforementioned keyboard and the aforementioned input device as well as a detection calculation means and a transmission means. The twenty-first invention solves the aforementioned problems with a card type information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a solar battery that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration from the point of contact input repeatedly along a trajectory as detection information.

[0014] The twenty-second invention solves the aforementioned problems with an IC card equipped with an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration for the signal or voltage corresponding to that touch according to the contact or pressure from the point of contact input repeatedly along a trajectory. The twenty-third invention solves the aforementioned problems with an IC card equipped with a character display means or a luminous means with a luminous element, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration for the signal or voltage corresponding to that touch according to the contact or pressure from the point of contact input repeatedly along a trajectory. The twenty-fourth invention solves the aforementioned problems with an IC card equipped with a character display means or a luminous means with a luminous element, an arithmetic device and a memory that is equipped with an input device that is comprised of a touch detection means with varying densities of touch detection sensors continuously arranged in a straight line, plane curve or arc; and a detection calculation means for any or all of the number of contact events, length, time, direction, speed, velocity and acceleration for the signal or voltage corresponding to that touch according to the contact or pressure from the point of contact input repeatedly along a trajectory. The twenty-fifth invention solves the aforementioned problems with an IC card where there are multiple items and a cursor to display which items are currently selected on the aforementioned display means; and a means to synchronize the movement of the event information calculation with the cursor by repeated contact detection using the aforementioned input device.

[0015] The twenty-sixth invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory, a keyboard and a touch pad containing a palm rest that is equipped with an input device that is comprised of an input device containing touch detection sensors continuously arranged in a straight line, plane curve or arc around the touch pad; and a detection means to detect the position on the input device touched by a finger. The twenty-seventh invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a keyboard that is comprised of an input device containing touch detection sensors along

a specific line or plane curve and a touch pad integrated with a palm rest; and a detection means to detect the position on the input device touched by a finger. The twenty-eighth invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory

and a keyboard that is comprised of an input device containing touch detection sensors around a touch pad along a specific line or plane curve and a touch pad integrated with a palm rest; and a detection means to detect the position on the input device touched by a finger. The twenty-ninth invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a keyboard that is comprised of a touch pad with a palm rest; a means for pointing on a two-dimensional plane on part of the touch pad where contact is not possible; and an input device containing touch detection sensors along a specific line or plane curve. The thirtieth invention solves the aforementioned problems with a portable information terminal equipped with a character and graphic display means, an arithmetic device, a memory and a keyboard that is comprised of a touch pad with a palm rest; and an input device containing touch detection sensors along a specific line or plane curve used as a touch position detection means along a specific line to identify sections visually from the touch pad surface contacted. The thirty-first invention solves the aforementioned problems with a portable information terminal with a click switch on the input device or on the input device around the touch pad.

[0016] In the first invention, the computer in this invention is an information terminal that can conduct pointing with smooth hand pressure on a keyboard containing a contact detection function. In the second invention, the computer in this invention is a portable information terminal that can conduct pointing with smooth hand pressure on a keyboard containing a contact detection function. In the third invention, the computer in this invention is an information terminal that can conduct pointing with smooth hand pressure on the keyboard and touch pad that have contact detection functions. In the fourth invention, the computer in this invention is an information terminal that can conduct pointing with smooth hand pressure on a keyboard containing a contact detection function and can effectively improve operability with cursor control and scroll display on the monitor. In the fifth invention, the computer in this invention is a portable information terminal that can conduct pointing with smooth hand pressure on a keyboard containing a contact detection function and can effectively improve operability with cursor control and scroll display on the monitor. In the sixth invention, the computer in this invention is an information terminal that can conduct pointing with smooth hand pressure on the keyboard and touch pad that have contact detection functions and can effectively improve operability with cursor control and scroll display on the monitor. In the seventh invention, the computer in this invention is a portable information terminal that can conduct pointing with smooth hand

pressure on the keyboard and touch pad that have contact detection functions and can effectively improve operability with cursor control and scroll display on the monitor.

[0017] In the eighth invention, the computer in this invention is a personal computer that can perform the aforementioned operations. In the ninth invention, the computer in this invention is a portable personal computer that can perform the aforementioned operations. In the tenth invention, the computer in this invention is a work station that can perform the aforementioned operations. In the eleventh invention, the computer in this invention is a word processor that can perform the aforementioned operations. In the twelfth invention, the computer in this invention can conduct pointing with smooth hand pressure on non-contact sensors on the keyboard. In the thirteenth invention, the computer in this invention is a portable information terminal that can input one-dimensional displacement values from contact detectors arranged on a trajectory so command input can be performed by data pointer or cursor movement or scrolling. It is also possible to quickly process calculation of the speed, velocity and acceleration with pointer or cursor control. In the fourteenth invention, the computer in this invention is a portable information terminal that can input one-dimensional displacement values from contact detectors arranged on a trajectory so command input can be performed by data pointer or cursor movement or scrolling. It is also possible to quickly process calculation of the speed, velocity and acceleration with pointer or cursor control. Due to the integrated structure of the switching means with this function, analog input and digital on/off operation is possible without moving the fingertip from one position.

[0018] In the fifteenth and sixteenth invention, the computer in this invention is a PDA (Personal Digital Assistant) that can input one-dimensional displacement values from contact detectors arranged on a trajectory so command input can be performed by data pointer or cursor movement or scrolling. It is also possible to quickly process calculation of the speed, velocity and acceleration with pointer or cursor control. Due to the integrated structure of the switching means with this function, analog input and digital on/off operation is possible without moving the fingertip from one position. In the seventeenth and eighteenth invention,

the computer in this invention is an IC card type information terminal that can input one-dimensional displacement values from contact detectors arranged on a trajectory so command input can be performed by data pointer or cursor movement or scrolling. It is also possible to quickly process calculation of the speed, velocity and acceleration with pointer or cursor control. Due to the integrated structure of the switching means with this function, analog input and digital on/off operation is possible without moving the fingertip from one position. In the nineteenth invention, the computer in this invention is a PC card type information terminal that can input one-dimensional displacement values from contact detectors arranged on a trajectory so command input can be performed by data pointer or cursor movement or scrolling. It is also possible to quickly process calculation of the speed, velocity and acceleration with pointer or cursor control. In the twentieth invention, the computer in this invention is a computer with a transmission means that can perform the aforementioned operations. In the twenty-first invention, the computer in this invention is a card type information terminal equipped with a solar battery that can input one-dimensional displacement values from contact detectors arranged on a trajectory so command input can be performed by data pointer or cursor movement or scrolling. It is also possible to quickly process calculation of the speed, velocity and acceleration with pointer or cursor control.
[0019] In the twenty-second invention, the computer in this invention is an IC card that can input one-dimensional displacement values from contact detectors arranged on a trajectory so command input can be performed by data pointer or cursor movement or scrolling. It is also possible to quickly process calculation of the speed, velocity and acceleration with pointer or cursor control. In the twenty-third invention, the computer in this invention is an IC card equipped with a character display means or a luminous means with a luminous element that can input one-dimensional displacement values from contact detectors arranged on a trajectory so command input can be performed by data pointer or cursor movement or scrolling. It is also possible to quickly process calculation of the speed, velocity and acceleration with pointer or cursor control. In the twenty-fourth invention, the computer in this invention is an IC card equipped with a character display means or a luminous means with a luminous element that utilizes a touch detection means arranged with varying densities so the aforementioned processes are possible, and continuous input can be conducted by changing the number of input events per touch position along a trajectory. In the twenty-fifth invention, the computer in this invention is an IC card equipped with a cursor synchronized with the continuously input events that can visually check multiple items, multiple data selection and multiple data

input. In the twenty-sixth invention, the computer in this invention is a portable information terminal that can input one-dimensional displacement values from a palm rest. In the twenty-seventh through the thirty-first invention, the input device has an integrated structure with the touch pad to input one-dimensional displacement values so it is possible to produce a portable information terminal with excellent maintenance, limited assembly and excellent operability.

[0020]

[Embodiment Examples] Using the following figures as references, the embodiment examples for this invention are described in the following order.

(1) Structure of the touch detection means
(2) Example of keys with touch detectors on the tops
(3) Example of touch operation keyboard
(4) Example of input device with groups of keys
(5) Example of block diagram showing the touch operation keyboard and input device electronic circuit
(6) Example of touch detection switch (touch operation input device and electronic part)
(7) Example of circuitry for the computer system when integrated with a touch operation input device
(8) Embodiment example of the portable information terminal in this invention
(9) Embodiment example of the PDA in this invention
(10) Embodiment example of the IC card type information terminal and PC card type information terminal in this invention
(11) Embodiment example of the IC card in this invention
(12) Embodiment example of the portable information terminal in this invention combined with a touch operation input device.

[0021] (1) Structure of the touch detection means

The touch event detection circuitry using specific touch detection sensors is as follows. This is a circuit that outputs signals or voltage for a position touched according to contact or pressure.

[0022] The structure using an electrostatic induction detection means (electrostatic capacity) as the touch position detection means with touch detection sensors involves a detection method that has multiple capacitors C1, C2, C3....through non-conductive glass for detecting contact via fingers where the capacity of these capacitors C1, C2, C3....changes according to the touch or proximity. These capacitors C1, C2, C3....are connected. As shown in Figure 1, there is a pulse generation circuit 1 that transmits frequency signals generated by the CR phase transmission circuit 3 by the voltage through the scanning drive circuit 2 that houses a decoder and counter to the frequency comparison circuit 4. These signals are compared with standard signals transmitted from the pulse generation circuit 1 to the frequency comparison circuit 4 via the control circuit 5. The

signals from the frequency comparison circuit 4 and the standard signals from the control circuit 5 are simultaneously transmitted

to the decision circuit 6. Based on the decision for both signals, the capacitor capacity is detected by the changes in touch at the point of finger contact. With this method, even without contact, the capacitor capacity changes so if the detection accuracy is high enough, it can be a non-contact type keyboard. The basic structure of the circuitry is the same.

[0023] Next is a description of the structure using an optical detection means (infrared detection type) as the touch position detection means of the touch detection sensor. This is a method that performs finger touch detection as shown in Figure 2. There are luminous elements 7 such as LED and light receiving elements 8 such as phototransistors that are arranged 1:1 along the keypad. These light receiving elements 8 light up sequentially according to the demultiplexer 9 and the light is simultaneously received by the light receiving elements 8 via the multiplexer 9. The luminescence of the light received by these light receiving elements 8 is detected by the decision circuit 6. Based on the decision of the level of light, the finger touch position is detected. 12 refers to the control circuit that is connected to the demultiplexer 9, the multiplexer 10, and the decision circuit 6 to control the circuit functions. The dotted line box in Figure 2 is the AD converter 13 between the multiplexer 10 and the decision circuit 11. Analog value detection conducted via contact points can improve the detection accuracy. With this method, if light is generated from the luminous element on the bottom, it can be a non-contact type keyboard and input device with sufficient light and detection accuracy. It is thought that this optical detection means will be a non-contact type in the future.

[0024] Next is a description of the structure using a direct current resistance detection method as the touch position detection means of the touch detection sensor. There are metal contacts for the touch position to perform finger contact detection. The detection circuit shown in Figure 4 detects the high level of resistance such as a finger contact extending between the metal contact point switches SW1~SW7 with 2MΩ of input resistance. The high resistance detection terminal switch module SM converts the output level OUT1~OUT7 to 2 HIGH, LOW values that are used as the switches to detect when the metal is touched.

[0025] Next is a description of the structure using a resistant film type detection means (resistant film electrode type) as the touch position detection means of the touch detection sensor. As shown in Figure 6, a standard resistant film 15 is sandwiched between the electrode A and electrode B. This generates the potential distribution Q of the drive voltage and grounded voltage. As shown in Figure 7, the electrode 16 that is conductive to this resistant film 15 is installed in a parallel direction either under or on top of the

resistant film 15. When touched with a finger, there is contact between the resistant film 15 and the electrode 16. This contact detects the position of the point of contact by measuring the changed voltage on the voltage measuring device 17. With any type of detection means as described above, the point of contact is output as position data with one-dimensional coordinates that correspond 1:1 to its trajectory. In particular, using the analog method, if close enough, it is possible to easily identify the direction of the fingertip movement and with the digital method, it is possible to identify if there are many points.

[0026] Next is a description of the structure using a moveable electrode style detection means (moveable electrode switch type) as the touch position detection means of the touch detection sensor. As shown in Figure 8(a), either the electrode arranged along a line or the electrode arranged intermittently with gaps filled with spacers 21 is designated as the moveable electrode 22 while the other is designated the stationery electrode 23. Using the finger, pressure is applied to the moveable electrode 22 to contact the stationary electrode 23 side. The position and time of the point of contact is used to detect the finger contact point. In Figure 8(b), the counter 19 is activated by the control circuit 18 to sequentially detect the points of contact S1, S2, S3 from the decoder 20. At this point, the part of the contact point that is ON has LOW voltage to detect the point of contact.

[0027] The method and structure is nearly the same as given above, but the structure using the moveable contact as the touch detection sensor on the touch position detection means is described next. As shown in Figure 9, this has nearly the same configuration as the aforementioned moveable electrode method but the moveable contact is utilized as the touch position detection means with touch detection sensors. The contact position or contact event can be detected by contacting the moveable contacts M1-M5 on the contact points S1-S5 formed as groups of 2 arranged in a continuous line. Figure 10(a) is constructed of a film shaped moveable part 27 with protrusions 24 on the top and a conductor 26 on the bottom, and a substrate 23 with spacers 21 and contact points S. With the pressure of a finger, the film shaped moveable part 27 short-circuits the curved contact point S. Thus the point of contact is detected via the electrical current position and time. (b) shows this method with a switch on the IC card. Alternatively, this can be applied to touch detection methods such as the electrostatic method and the ultrasonic detection method.

[0028] (2) Example of keys with touch detectors on the tops

As shown in Figure 11(a), there are touch detection sensors on the tops of the keys. The keys with switching means to turn the contact points on and off by movement or pressure have touch detection sensors 28 on the tops and a means to detect a single touch. As shown in Figure 11(b), there are multiple touch detection sensors 28A, 28B,

28C...on the tops of the keys. As shown in Figure 11(c), there is a touch pad 29 on the tops of the keys and that utilizes a means to detect the contact. At this point, standard key input is conducted by pressing on the touch detection sensor part 30. The conduction path can use cables, contact pins or flexible contact points inside the key or

as shown in Figure (d), exterior cables 31 are also acceptable. The conduction path can also be constructed of spring contact points or a flexible conductor. One example of the internal structure of the keys with touch detection sensors on the tops from Figure 11 is shown in Figure 12. By touching this touch detection sensor 28 with the fingertip, an electrical signal or voltage is generated from the touch detector 30 and transmitted along the conduction path on the substrate 39 from the external connection terminal 32 along the flexible contact point 38 via the contact point 37. Resistance is applied in a specific direction from the touch detector 30 and when the top of the keys are pressed via such resistance, the contact point 42 inside the glass tube 41 contacts the magnet 43 and the switching means is turned on. It is also acceptable for the contact point 42 switching means to be replaced by an elastic contact point.
[0029] Figure 13 shows an example of the keys with touch detection sensors 28 on the tops. Using the moveable contact 44, the switching means is turned on by contact point 33A and contact point 33B. A rubber elastic part 45 is used for the touch detector resistance. As shown in Figures 11, 12 and 13, the conduction path for the keys with touch detection sensors 28 on the top can be constructed to travel inside the key itself, to travel outside with a cable, to travel inside a cable, using a contact pin, using the aforementioned elastic contact point, using a spring contact point, or using an elastic part as the conductor. The cable can travel inside a vertical tube so it does not contact anything. Typically, the top of the keys are indented to match the shape of a fingertip but the keys in this invention can have protruding, irregular or smooth tops. If the cross-section is irregular, protrusions or indentations can be formed in the center of the surface. Also, the keys used in the input device with a keyboard for this invention have a switching means that corresponds to the pressure on the click button or push switch. This switching mechanism can involve a momentary method, an alternating method or a locking method. As shown in Figures 11, 12 and 13, the keys on the touch detectors have a continuous arrangement as shown in the cross-section diagram of Figure 14 so the circuit contact and non-contact detection functions are effective. Figure 14(a) shows a combination of keys with multiple touch detectors; (b) shows the structure of the touch detection sensors on the tops of keys; (c) shows the integration of the touch detectors with the elastic part using the key pressure from (b); (d) shows non-contact sensors 47 (such as electrostatic induction non-contact detection sensors, or optical or ultrasonic methods using light or sound wave reflection) on a substrate on the bottom.
[0030] (3) Example of touch operation keyboard

Contact detection or non-contact detection sensors are distributed on the entire keyboard surface as shown in Figure 15(a). Arrangements such as the intersecting shapes in Figure 15(b) or the left/right split in Figure 16(b) are also possible. For a matrix arrangement, as shown in Figure 15(a), the sensors can form an intersecting conduction path across the XY surface of the keyboard, or they can be distributed as individual key tops. The keys 36 on the touch detectors are arranged as in (a) and there are touch detection sensors across the entire keyboard so if the touch detection surface is the entire keyboard surface, it is possible to calculate the position touched with a hand. When typing, it is possible to divide the touch detection control into the home row keys of ASDFGHJKL; or ASDF and JKL; or divide them in the middle between G and H. This is different from pointing using fingertips for existing touch panel control processing and uses the palm of the hand for pointing during input control processing. As shown in Figure 16(a), if they are continuously arranged along a line, it is possible to conduct simple touch input with the fingertips or process continuous analog input smoothly with the fingertips. In this case, the control process can involve either the detection method of contact with the tops of keys or the detection method with two contacts. As shown in Figure 17(a) and (b), for click input, there can be click keys or buttons (48A, 48B) at the site of the thumbs. Clicking can be conducted by moving the palm of the hand up and down in the same position. Also, they are constructed so two of the click keys can be used as pointing devices, with one used for up/down scrolling and one used to cancel processing.

[0031] The keyboard can be a Japanese specialty keyboards such as ASCII, JIS or thumb shift, or an ergonomically engineered keyboard. If the palm of the hand can contact the top of entire keyboard, they can be placed on the bottom side or protruding from a curved surface. One example of the means to control the keyboard in this invention is explained as follows. Figure 18(a) shows a personal computer monitor and (b) shows the keyboard. First, when typing, the fingers on both hands start on the keys ASDFJKL;. This is called the home row. The left hand remains on the home row while the right hand moves along the keyboard as shown in Figure 18(b) for the touch input operation. There are more than 8 key tops for contact on this keyboard.

Once the number of contact key tops is identified, the contact input operation starts. The cursor moves down the screen by moving the palm forward while maintaining contact. Figure 19 is an example of scrolling down the screen by moving the palm forward in the same manner. The range of palm motion is from when the cursor is moved down while the palm maintains contact and then up when the palm no longer touches. When the palm is removed from the touch surface and then contact is made again in the front, the cursor continues to move down. Horizontal motion is in the same manner, with the cursor moving to the right as the palm moves to the right. As shown in Figure 18(b), when the palm is moved in a circular direction, the cursor makes the same motion. When input is received in the manner above, it is nearly identical to the standard touch panel method without the differences of the fingertip and palm. The big difference is that the fingertip does not reach the standard touch panel. It is easy for the palm to reach the entire keyboard. To handle this, there can be a means to calculate the range of the palm with a touch detection algorithm, the number of contact points can be calculated or the position of the palm on the keyboard can be determined by conducting both. When performing touch detection processing on this keyboard, it is acceptable to ignore the four touch detectors not used by the fingers placed on the home row (ASDF and JKL;). It is also acceptable to have a setting that ignores either the right side or the left side. With compact portable information terminals, it is acceptable to start touch detection processing based on the size of the area touched on the simple keyboard. It is also possible to use the entire keyboard as touch detectors for specific click operation.

[0032] (4) Example of input device with groups of keys

Figure 20 shows an example of an embodiment example of an input device with keys 36 equipped with touch detection sensors on the tops arranged in a row with fingers slid between the tops of the keys to input touch events along a row or movement distance. Figure 20(a) shows a column on the buttons on the surface of the device while (b) shows a cross, (c) shows two columns and (d) shows three rows or radial lines. Figure 21(a) is an example showing an input operation part on an information processing device combined with an input device for this invention, and is an electronic mechanism with keys 36 with touch detection sensors at the tops arranged in a line. 50 refers to the speakers and 51 is the luminous element LED. As shown in (b) and (c), event input occurs by continuously touching the tops of the keys while moving the thumb from the top to the bottom. At this point, it is synchronized with the touch event and audio can be heard from the speaker, or light can be generated on the LED 51 as indicated in the figure. When the required number of events have been input, as shown in (d), the key is pressed. This selects the targeted

functions and data. It is possible to continuously input events with better directivity by repeatedly using the finger in the same direction.

[0033] (5) Example of block diagram showing the touch operation keyboard and input device electronic circuit

Figure 22 is a block diagram showing the circuitry of the keyboard and input device in this invention. The touch detector 55 is the contact/non-contact detection sensor described in (1) arranged intersecting between the X and Y axes. Signals are obtained in the contact/non-contact detection circuit 53 and the touch event or touch position data are transmitted from the control circuit with the arithmetic controller 52 to the computer via the transmission interface circuit 54. When contact points are detected for one-dimensional displacement values or when the touch detectors are made of touch detection sensors arranged in a string, the structure involves circuits arranged in rows of X-axis touch sensors as explained in (1) above. The pressure switch 56 on the keyboard transmits data input from pressure switch contact points intersecting with the keyboard encoder circuit 57 from the transmission interface circuit via the control circuit. If light or audio generation is synchronized with a touch event, this is generated from the LED 51 or speaker 50 via the control circuit. The light or audio can also be output from the host computer.

[0034] (6) Example of touch detection switch (touch operation input device and electronic part)

This is a touch detection switch on a touch detection means described in (1) above that has two forms. The first has the switch located on the switching means separate from the touch detection means as shown in Figure 23(a), (b) and Figure 25(e), (f) [translators note: Figure 25 (e) and (f) do not exist]. Existing card type calculators are available on the market but these do not have a means that performs event and data capture as well as cursor movement by a fingertip along a row. The second is the touch detection means integrated with a switching means. Figure 23 shows the touch detection means arrangement. In Figure 23(a), the switch is parallel to the linear touch detectors 58. With this, after the finger moves, the switch is immediately pressed down. (b) shows touch detectors 58 arranged in a curved line. Here, after the round detector is operated, the switch 59 is immediately pressed down. (c) shows cross-shaped touch sensors and (d) shows touch sensors in varying densities. Figure 24 shows touch detection sensors in non-uniform densities

with (a) showing the highest density at the right side. With the part on the right side, there can be a great number of input event items input. With subtle fingertip input operation, a more effective input operation can be conducted on the information processing device. (b) shows detection densities increasing on the left and right ends. (c) shows touch detection sensors 60 arranged in non-uniform densities around a circle where the density increases towards the bottom. (d) shows the same circle where the density increases in a counterclockwise direction.

[0035] In particular, with IC cards such as credit card type information processing devices as shown in Figure 25, there is a substrate 23 on a hard plate K made of metal. There are sets of two contact points S on the substrate, followed by spacers 21 and then protrusions 24 on the top surface. There are moveable contacts made of conductors below the film sheet. As shown, a touch event is generated by pressure from the top or bottom via a finger and this finger can control the input items by sliding. Figure 25(b) shows the touch detection input device along a linear trajectory with varying densities. In this case, the distance and number of input events is not proportional. The number of input events varies by touch position. Figure 26 shows the switch on the portable information terminal device. (a) shows it on a horizontal line in the center of the front; and (b) shows a vertical touch position detection sensor in the center of the front. In (c), there is also a switching means in a curved line in the center of the front. In (d), there is a switching means surrounding the vertical touch position detection sensor located on the top of the side of the device. In (e), there is a sliding switching means installed in a curved shape that can be easily pressed with the finger and the thumb. (f) has a vertical touch detection sensor on the side of the device and a switching means that can be activated by sliding a finger vertically. There can also be a round touch position detection sensor in the center on the front of the device.

[0036] The following figure shows an example of the touch detection means, the switching means and the touch detection switch (touch operation input device and its electronic parts). As shown in Figure 27, there are touch position detectors 30 with touch position detection sensors 28 arranged along a straight line or a curved line that can be moved horizontally within a given range. The electrical signal or voltage from this touch position detector 30 and sensor becomes the conduction path. There is a flexible contact 61 on the substrate 39 equipped with contact points. In the normal state, the touch position detector 30 is pressed horizontally to the spring 62. There is a push switch 63 on the substrate 39 equipped with contact points that press the touch position input part against the spring.

As shown in Figure 28(b) and (c), there is a touch position input part 30 that generates electrical signals or voltage corresponding to the touch position detection sensor 28 touched with a fingertip arranged along a specific line, plane curve or arc; a substrate 39 that has a push switch 63 and an elastic contact point 38 that acts as the conduction path for the touch position input part 30; a support 68 on the substrate 39 that holds the swinging part of the hinged swinging part 67 holding the touch position input part 30 containing a protrusion 66 on the bottom that corresponds to the push switch 63; a protruding operating part 69 on one edge of the swinging part 67 that drives the switch 63 to start swinging with the swinging part 67; and a switch 63 that can be pressed when sufficient pressure is applied to the parts of the touch position detector 28. As shown in Figure 29(a) there is a touch position input part 30 that generates electrical signals or voltage corresponding to the touch position detection sensor 28 touched with a fingertip arranged along a specific line, plane curve or arc; and a push switch 63 that uses the one way push mechanism 70 to press against the touch position input part 30 in a specific direction to turn it on and off. It is also possible to use a cable 31 or a push mechanism as the conduction path relating to touch detection. (b) shows an example of switches with 2 adjacent touch detection sensors while (c) shows 3 touch detection sensors.

[0037] In the switching mechanism in Figure 30(a), the information processing device cases 71 have several touch position input parts 30 and push switches 63 operated from the top that are located on the top of the substrate 39 that are connected into a conduction path via the cable 31 and the touch position detection sensor 28. The touch position input part 30 is connected to the case and integrated with the elastic resin part 72 by the top case 71 and the vertical support 73. There is also a push switch 63 that can be pressed when sufficient pressure is applied to the parts of the touch position input part 30 against the elastic resin part 72 in a specific direction. The switching mechanism shown in Figure 30(b) has a touch position input part 30 that generates electrical signals or voltage corresponding to the touch position detection sensor 28 touched with a fingertip arranged along a specific line, plane curve or arc; a substrate 39 that has a push switch 63 with a stationery contact point 74 for when the touch position input part 30 is pressed from the top and a vertical axle opening 75 to support the touch detection input part 30. The axle 68 supports the touch position input part 30 so it can swing back and forth. The operating part 76

formed of a tongue shaped protrusion makes a seesaw shape so two types of input can be performed on two push switches 63A and 63B.
[0038] The switch shown in Figure 31(a) has touch position detection sensors 28 and a substrate 39 upon which there is a touch position input part 30 with a cable 31 that acts as the conduction path and a push switch 63. There are supports 77 on both sides of the touch position detector 30 that are inserted into the guide openings 78 on the substrate 39. There is a coil shaped spring made of an elastic material between the touch position input part 30 and the substrate 39 that presses against the stop part 39A of the substrate 39. When there is sufficient pressure against the touch position detector 30 via the elastic spring 62, the push switch 63 can be pressed down using the vertical protrusion 79 in the center. In Figure 31(b) the touch position detector is shaped like a push button. The support 77 on the bottom of the touch position detection sensor 28 is on the substrate 39 and can be inserted into the guide opening 78 via the coil shaped spring 62 between the touch position input part 30 and the substrate 39. Pressing only the switch 80 can turn each switch on and off. The switch in Figure 31(c) is the same. Figure 32(a), (b) show a device that has two push switches 63B and 63C using the rubber elastic part 81. As shown in (c), (d) and (e), up/down force is exerted against the spring 62, and left/right force is exerted against the plate spring 82A, 82B. The three push switches 63A, 63B and 63C can be pressed down. As shown in Figure 33(a), all of the detectors on the touch position detection sensors 28 arranged in a circle can be pressed. There is a round switch 59 in the center of the circle. As shown in Figure 34, there can be contact points on elastic sensors or moveable contacts. As shown in Figure 35, the touch detectors 28 located around a circle are pressed against the round moveable contact 44 with a ring shaped rubber part 83 where the contact points S are for multiple contact point switches.
[0039] (7) Example of the circuitry for the computer system when integrated with a touch operation input device
Figure 36 shows the circuitry for systems with input processing means for this invention. The electrical signal or voltage is detected by the touch detection circuit 84 by finger touch input to the touch position detection sensor 28. It is identified by the operation control circuit 85 (including CPU, DSP, MPU and memory) and depending on the situation, the cursor is shown via the display circuit. Depending on the processing, audio is heard from the speakers 50 via the audio circuit 86 and light can be generated from the luminophor 87. If the application system is not housed in the operation control circuit 85, information output to the application system is conducted. If the application system is housed in the operation control circuit, linear output is not performed.

[0040] (8) Embodiment example of the portable information terminal in this invention
Next is a description of the embodiment examples in this invention, using the figures as references. This is a portable information terminal equipped with a character and graphic display means, an arithmetic device and a memory that is equipped with touch detection sensors on the tops of the keys; multiple keys with a switching means to turn the contact point on and off by movement or pressure; a keyboard that can detect contact events generated by touching each key and can detect the state of the contact points with the switching means; a touch pad; and a means to detect the movement of fingers or palms contacting the keyboard and touch pad via a touch pad that is combined with touch detection sensors on the tops of the keys. Examples of a portable information terminals include personal computers, laptop computers, notebook computers or portable work stations but this invention refers to portable personal computers. Figure 37 shows of the portable information terminal in this invention combined with a touch operation keyboard 90. Portable refers to the use of a foldable liquid crystal panel display 93 for transporting. 91 is the click button. There is a floppy disk drive or CD-ROM drive on the peripheral storage device 94 so the interface such as CardBus standards for PCMCIA specifications can be integrated on the PC card slot 92. The other standard required technology has been abbreviated. Figure 38(a) shows the portable information terminal with a palm rest in front of the touch pad divided into left/right sections 96A, 96B. (b) shows an example with a touch pad 96 and a palm rest. In this figure 38, the area of the touch position detector is larger than with only a keyboard so the detection accuracy can be increased.
[0041] Figure 39 is a block diagram showing the portable information terminal device circuitry for the embodiment examples in this invention. There is a CPU 97 connected to the system bus 106. Connected to this system bus is a memory 98, a display circuit 107 and liquid crystal panel 89, an audio circuit 86 and speaker 50, a serial transmission circuit 99 and modem 100, an I/O interface circuit 101, hard drive 102, floppy drive 103, a parallel transmission circuit 104 and printer 105, as well as

a keyboard controller and its transmission circuit 54. For the keyboard, there are intersecting touch detectors 55 with contact/non-contact detection sensors. Signals from the contact/non-contact detection circuit 53 are transmitted as touch events or touch position data to the system bus that has a central processing unit via the control circuit 52 and the transmission interface circuit 54. The pressure switch 56 on the keyboard and input device transmits the input from the contact point on the pressure switch intersecting with the keyboard encoder circuit 57 as data from the transmission interface circuit via the controller circuit. It is also possible to have a parallel connection with the central processing unit so connection using USB (universal serial bus) is possible. When there is a touch pad, there is a touch pad unit 110 on the wire that contains the touch pad control circuit 109 and the touch pad 108. This touch pad is combined with the touch detectors on the keyboard to use for detection control. If there is light or audio generated, it is synchronized with the contact event and output from the LED 51 or speaker 50 via the control circuit. Light or audio can also be output from the system bus. The recently developed circuit blocks containing the CPU and memory have a bus configuration and so have become more complex. Improvements have also been made to improve the required technology such as other peripheral circuits and interface regulations. This invention is a new concept and is a special combination so additional technical descriptions are necessary.

[0042] (9) Embodiment example of the PDA in this invention

PDAs (Personal Digital Assistant) are portable information terminals that typically contain a case that includes a liquid crystal display without a keyboard, a transparent touch panel on this display, push keys, a central processing unit, a memory, an interface circuit for transmissions with the external unit and a card bus type interface slot. The loaded software includes a PIM (Personal Information Manager) that performs scheduling and an address book. Some also have software for transmissions to desktop personal computers and internet connections. This invention avoids the dirty monitors that come from the transparent touch panel being touched with fingers and the requirement to use two hands for touch by a pen by providing a combination touch input device. For example, as shown in Figure 40(a), there is a touch operation input device 112 with a push switch on the front of the device; as shown in (b), there is a round touch detector 60. As shown on the side in Figure 41(a), the touch operation input device with a push switch can be operated with one hand. As shown in (b), the transmission means includes touch detectors 58 and a confirmation switch 59 on the front. Figure 42 is a block diagram showing examples of the PDA, IC card information terminal, PC card information terminal and the IC card basic

circuitry. On these information terminals, the minimum requirements include a common central processing unit 97, RAM 117 and ROM 118 memory where the RAM is the program work area. It is possible to find many ROM that are rewritable. Also included is a monitor 89 and display circuit, a control circuit 119 and input keys 114 for the push keys or ten-keys, a touch detection circuit 84 made of the special feature in this invention-the touch operation mechanism, touch sensors 58 on a trajectory and a confirmation switch 59. In particular, there is a parallel or serial I/O port for transmissions to a personal computer. With PC cards, there is a card bus interface circuit 116 and connector for inserting into the personal computer card socket. With credit card type IC cards, interface circuits can be used for the transmission connector.

[0043] (10) Embodiment example of the IC card type information terminal and PC card type information terminal in this invention As shown in Figure 43(b), the IC card information terminal is the same size as a standard credit card, and contains a basic circuit with a CPU and memory. This IC card information terminal can be inserted into the PC card slot on a personal computer. (a) shows an IBM brand ChipCard VW2000 that is foldable for transport that can be inserted into a PC slot during operation so this is an example with touch detection sensors on a line. (b) is an example of touch detection sensors on a line on the PC card input operation unit containing PDA functions. (c) is an example of touch detection sensors on a line on the side of the information terminal that has a PC card socket with mobile telephone and paging functions.

[0044] (11) Embodiment example of the IC card in this invention The IC card is constructed by wire bonding, soldering or gluing a semiconductor chip to a thin film substrate. This substrate is enclosed in resin and inserted between film sheets or between a hard metal sheet and a film sheet. Figure 44 shows a credit card type IC card where (a) shows an example containing touch detection sensors in a line where the touch detection density is not uniform. (b) is an example containing touch detection sensors arranged in multiple lines. (c) is an example containing a solar battery and touch detection sensors in a circle. (d) shows an IC card with touch detection sensors in a horizontal line during operation.

With IC cards, it is possible to perform fine input operations with the fingertips with a varying number of event inputs via the non-uniform density. The touch distance and number of touch events is not proportional.

[0045] Embodiment example of the portable information terminal in this invention combined with a touch operation input device

Figure 45 is a front view of a portable information terminal with touch detection sensors arranged in a line adjacent to the touch pad. Because they are adjacent to the touch pad, assembly costs are reduced. Figure 46(a) shows a section of an integrated touch pad and input device for a personal computer. The dotted line is the touch pad. (b) shows the color display of the input device on the touch pad. (c) shows a section of the input device unit where lines can be drawn up/down/left/right. (d) shows the bottom of the input device unit. (e) is the top of the device and (f) is the periphery. For color display or printing lines without using the input device, the touch pad can be utilized. These are illustrative examples to describe this invention but the user should understand if there are any omissions in the spirit or scope of this invention. The aforementioned embodiment examples are simply for illustration purposes and should not be interpreted as limitations on the scope of this patent.

[0046]

[Effect of this Invention] With this invention of an information terminal containing a keyboard, there are touch detectors on the tops of the keys so pointing operation is possible without removing the hand from the keyboard, so the operability of the information processing terminal is improved. PDA (Personal Digital Assistant), PC card type information terminals, IC card type information terminals and portable information terminals such as credit card sized IC cards can be operated by multiple continuous event input. In particular, lightweight information processing devices such as IC cards that cannot use rotating operation input devices demonstrate improved operability relative to multiple item selection and input. Finally, since the touch pad is combined with an integrated one-dimensional displacement value input device, it is possible to obtain a portable information terminal with excellent operability, maintenance and cost performance.

[Brief Description of the Figures]

[Figure 1] This is a circuit diagram of the electrostatic induction detection method for the embodiment examples in this invention.

[Figure 2] This is a circuit diagram of the optical detection method for the embodiment examples in this invention.

[Figure 3] This shows the arrangement of the luminous elements and light receiving elements found on the optical detection means for the

embodiment examples in this invention; (a) is a cross-section; (b) is an overhead view.
[Figure 4] This shows another arrangement of the luminous elements and light receiving elements found on the optical detection means for the embodiment examples in this invention.
[Figure 5] This is a circuit diagram of the direction current resistance detection method for the embodiment examples in this invention.
[Figure 6] This summarizes the resistant film detection means for the embodiment examples in this invention; (a) shows the arrangement of the resistant film; (b) illustrates the voltage distribution.
[Figure 7] This is a circuit diagram showing the same resistant film detection means.
[Figure 8] This shows the moveable electrode detection means for the embodiment examples in this invention; (a) is a cross-section; (b) is the circuit diagram.
[Figure 9] This shows the circuit diagrams of the moveable contact detection means for the embodiment examples in this invention.
[Figure 10] This shows the moveable contact detection means for the embodiment examples in this invention; (a) is the summary; (b) is the cross-section showing it installed on an IC card.
[Figure 11] This is a side view of the key switch on the touch detector of the key tip for the embodiment examples in this invention. (a) is one with a sensor on the top of a key, (b) is one with multiple sensors, (c) and (d) are those with a touch sensor means.
[Figure 12] This is a cross-section of one example of a key switch on the touch detector on the top of a key for the embodiment examples in this invention.
[Figure 13] This is another cross-section of one example of a key switch on the touch detector on the top of a key for the embodiment examples in this invention.
[Figure 14] This is a cross-section of the keyboard and input device for the embodiment examples in this invention; (a) is a cross-section of the structure for multiple keys with multiple touch detection sensors on the tops; (b) is a cross-section of the structure for multiple keys with touch detection sensors on the tops; (c) is a cross-section of the structure for multiple keys arranged with touch pads on the tops of keys; (d) is a cross-section of the arrangement of non-contact detection sensors under the keyboard.
[Figure 15] This is an overhead view showing one example of the keyboard for the embodiment examples in this invention; (a) is one completely covered with keys with touch detection sensors on the tops; (b) is one with sensors spreading from the center according to the placement of the hands.
[Figure 16] This is an overhead view showing another example of the keyboard for the embodiment examples in this invention; (a) is one

where the touch detection sensors are arranged in a line at the top; (b) is one where the contact areas are split into left/right according to the placement of the hands.
[Figure 17] This is an overhead view showing another example of the keyboard for the embodiment examples in this invention; (a) is one where the click buttons are arranged at the site of the thumbs; (b) is an example where the click buttons are arranged diagonally at the site of the thumbs.

[Figure 18] This is an operational diagram of the keyboard for the embodiment examples in this invention. (a) shows the monitor with the cursor rotating in a clockwise direction; (b) shows the left hand on the home row while the right hand is moved for the rotation.
[Figure 19] This is an operational diagram of the keyboard for the embodiment examples in this invention. (a) shows when the screen is scrolled using palm movement during screen editing for word processing; (b) and (c) show the left hand on the home row while the right hand is moved from the top to the bottom.
[Figure 20] This shows the information terminal with key switches on touch detectors on the tops of keys for the embodiment examples in this invention. (a) shows a linear arrangement; (b) shows a cross-shaped arrangement; (c) shows an arrangement of two columns; (d) shows three rows.
[Figure 21] This shows the information terminal with key switches on the touch detectors on the tops of keys for the embodiment examples in this invention. (a) shows an overhead view; (b), (c) show the LED flashing according to event input by moving the finger up and down; (d) shows the pressure switch being pressed down.
[Figure 22] This is a block diagram showing the keyboard and input device circuitry for the embodiment examples in this invention.
[Figure 23] This is a diagram of the arrangement of the touch detection sensors for the embodiment of this invention, (a) shows a linear arrangement parallel to a switching means, (b) shows an arc shaped arrangement adjacent to a switching means, (c) shows a linear perpendicular arrangement, (d) shows a multiple parallel arrangement and varying detection densities.
[Figure 24] This shows the arrangement of touch detection sensor with varying densities for the embodiment examples in this invention. In reality, when close to analog, there is no event generation point and the lengths are not uniform.
[Figure 25] (a) is a cross-section of the touch detection switches with varying densities for the moveable contact point method for the embodiment examples in this invention. (b) is an overhead view.
[Figure 26] This shows the arrangement of touch detection sensors for the embodiment examples in this invention. (a), (b) and (c) are front views; (d), (e) and (f) are side views.
[Figure 27] This shows an example of a touch operation electronic part with a horizontal sliding push switch for the embodiment examples in this invention.
[Figure 28] This shows another example of the touch operation electronic part with a push switch where (b) is a side view.
[Figure 29] This shows another example of the touch operation electronic part with a push switch.

[Figure 30] This shows an example of the touch operation mechanism with a push switch for the embodiment examples in this invention. (a) is the cross-section; (b) is a cross-section with 2 switches.
[Figure 31] This is a cross-section of a different structure of the touch operation mechanism with a push switch; (a) shows the flat type electronic part; (b) and (c) show the button type.
[Figure 32] This is another example of the touch operation electronic part with a push switch. (a), (b) have two points; (c), (d), (e) have three points.
[Figure 33] This shows the round touch operation electronic part with a push switch for the embodiment examples in this invention. (a) shows an integrated sensor and switch; (b) shows a separate sensor and switch.
[Figure 34] This shows the switching means for the embodiment examples in this invention. (a) is the cross-section, (b) is the front view.
[Figure 35] This shows another example of the touch operation electronic part with a push switch where there are multiple switches on the touch detectors arranged in a circle.
[Figure 36] This is a block diagram showing the touch detection input device circuitry for the embodiment examples in this invention.
[Figure 37] This shows the exterior of the portable information terminal containing a touch operation keyboard for the embodiment examples in this invention.
[Figure 38] This shows the exterior of the portable information terminal combining for the touch operation keyboard and the touch pad for the embodiment examples in this invention. (a) shows two touch pads; (b) shows one touch pad.
[Figure 39] This is a block diagram showing the portable information terminal device circuitry for the embodiment examples in this invention.
[Figure 40] This shows (a) the front view of the PDA and (b) the front view of the IC card information terminal for the embodiment examples in this invention.
[Figure 41] This is a front view of the portable information terminal for the embodiment examples in this invention.
[Figure 42] This is a block diagram showing the basic circuitry for the PDA, IC card information terminal, PC card information terminal and IC card for the embodiment examples in this invention.
[Figure 43] This shows a front view of the PC card information terminal for the embodiment examples in this invention.
[Figure 44] This shows the credit card type IC card for the embodiment examples in this invention; (a), (b) and (c) show the front view; (d) shows while operating.
[Figure 45] This is a front view of the portable information terminal with touch detection sensors arranged in a line adjacent to the touch pad for the embodiment examples in this invention.

[Figure 46] This is a front view of the touch position detection sensors either adjacent to or integrated with the touch pad on the portable information terminal for the embodiment examples in this invention.
[Description of Symbols]

1...pulse generation circuit
2...scan drive circuit
3...CR phase oscillator
4...frequency comparison circuit
5...control circuit
6...decision circuit
7...luminous element
8...light receiving element
9...demultiplexer
10...multiplexer
11...decision circuit
12...control circuit
13...AD converter
14...metal contact point switch
15...resistant film
16...electrode
17...voltage measuring device
18...control circuit
19...counter
20...decoder
21...spacer
22...movable electrode
23...stationary electrode
24...protrusions
25...conduction path pattern
26...conductor
27...film shaped moveable part
28...touch detection sensor
29...touch pad
30...touch detection sensor part
31...cable
32...terminal
33...terminal
34...one way push mechanism
35...key top support
36...key with touch detection sensor on top
37...contact point
38...elastic contact point
39...substrate
40...spring
41...glass tube
42...contact point
43...magnet
44...moveable contact
45...elastic part
46...cable socket
47...non-contact sensor
48...click button
49...monitor
50...speaker
51...luminous element LED
52...control circuit
53...contact/non-contact detection circuit
54...transmission interface circuit
55...contact detector
56...pressure switch
57...keyboard encoder circuit
58...touch detector
59...switch
60...round track shaped touch detection sensor
61...elastic contact point
62...spring

63...push switch
64...protrusion when push switch pressed
65...swing holder
66...protrusions
67...swinging part
68...holder
69...hinge shaped protruding part
70...one way push mechanism
71...top cover
72...flexible resin
73...vertical holder
74...stationery contact point
75...axle
76...operation part
77...support
78...guide opening
79...protrusion
80...switch

81...rubber flexible part
82...plate spring
83...ring shaped rubber part
84...touch detection circuit
85...operation control circuit
86...audio circuit
87...luminophor
88...operation control circuit
89...monitor
90...touch operation keyboard
91...click button
92...PC card slot
93...panel display
94...peripheral storage device
95...portable information terminal palm rest
96...touch pad
97...central processing unit
98...memory
99...serial transmission circuit
100...modem
101...I/O interface circuit
102...hard drive
103...floppy drive
104...parallel transmission circuit
105...printer
106...system bus
107...monitor circuit
108...touch pad
109...touch pad control circuit
110...touch pad unit
111...antenna
112...touch operation input device with push switch
113...PC card connector
114...input key
115...parallel I/O port interface circuit
116...card bus interface circuit
117...RAM
118...ROM
119...control circuit for 10-key
120...solar battery detection sensor part
121...one-dimensional movement

[page break (20) 11-194883]

[Figure 1]
decoder
counter
control circuit

[Figure 2]
[Figure 3]
[Figure 7]

[page break (21) 11-194883]

[Figure 4]
[Figure 12]
[Figure 6]
voltage
resistance

[page break (22) 11-194883]

[Figure 5]
high resistance detection electronic switch module
metal contact point switch

[page break (23) 11-194883]

[Figure 8]
[Figure 9]
[Figure 13]

[page break (24) 11-194883]

[Figure 10]
[Figure 11]
[Figure 14]

[page break (25) 11-194883]

[Figure 15]
[Figure 18]
cursor
[Figure 27]
[Figure 19]

[page break (26) 11-194883]

[Figure 16]
[Figure 20]
[Figure 25]

[page break (27) 11-194883]

[Figure 17]
[Figure 21]
[Figure 33]
[Figure 34]

[page break (28) 11-194883]

[Figure 22]
54 serial or parallel interface circuit
52 control circuit
53 contact/non-contact detection circuit
57 keyboard encoder circuit
55 touch detector
56 pressure switch
50 speaker

[page break (29) 11-194883]

[Figure 23]
[Figure 24]

sparse	dense
sparse	dense
sparse	dense
sparse	dense

[Figure 28]
[Figure 30]

[page break (30) 11-194883]

[Figure 26]
[Figure 31]
[Figure 35]
[Figure 44]

[page break (31) 11-194883]

[Figure 29]
[Figure 38]
[Figure 37]

[page break (32) 11-194883]

[Figure 32]
[Figure 40]
[Figure 45]

[Figure 36]
58 touch detection sensor
84 touch detection circuit
59 confirmation switch
85 calculation control circuit
display circuit
89 monitor
86 audio generation circuit
50 speaker
88 application system
87 luminophor

[page break (34) 11-194883]

[Figure 39]
100 public telephone circuit modem
110 touch panel unit
108 touch panel
109 touch panel control circuit
98 memory
107 display circuit
86 audio circuit
99 serial transmission circuit
101 I/O interface circuit
104 parallel transmission circuit

parallel or serial interface circuit
54 parallel or serial interface circuit
52 control circuit
53 contact/non-contact detection circuit
57 keyboard encoder circuit
55 touch detector
56 pressure switch
50 speaker

[page break (35) 11-194883]

[Figure 41]
[Figure 43]

[page break (36) 11-194883]

[Figure 42]
89 display circuit monitor
119 ten-key control circuit
114 ten-keys
59 confirmation switch
84 touch detection circuit
115 parallel I/O port PC
116 card bus controller PC card socket

[page break (37) 11-194883]

[Figure 46]